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GUIDELINES FOR DEVELOPERS OF HOSPITAL INFORMATION SYSTEMS

Abstract: Currently, many medical institutions are implementing information systems in their work that improve the quality of medical care and patient care, improve communication and speed of decision-making. This not only increases the effectiveness of the treatment, but also helps to reduce the number of errors of doctors and medical staff. The constant availability of information about the patient's health is very useful to ensure the continuity of their treatment. In addition, electronic systems help better manage finances, making all monetary transactions more transparent. Thus, there is a big need for the implementation of medical information systems. If you have a task to design or develop a system for a hospital, you should know the generally accepted standards and understand which set of subsystems is better to implement in the final product. This article can help a software architect or programmer quickly gain insight into the tasks of medical information systems, learn about standards such as Health Level 7 (HL7) and DICOM, and understand how to get started on a project.

Keywords: hospital Information System, HL7, DICOM, HIS Components.

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РЕКОМЕНДАЦИИ ДЛЯ РАЗРАБОТЧИКОВ МЕДИЦИНСКИХ ИНФОРМАЦИОННЫХ СИСТЕМ

Аннотация: В настоящее время многие медицинские учреждения внедряют в своей работе информационные системы, которые повышают качество медицинской помощи и обслуживания пациентов, улучшают коммуникацию и ускоряют принятие решений. Это не только повышает эффективность лечения, но также помогает уменьшить количество ошибок врачей и медперсонала. Постоянная доступность информации о состоянии здоровья пациента очень полезна для обеспечения непрерывности его лечения. Кроме этого, электронные системы помогают лучше управлять финансами, делая более прозрачными все денежные операции. Таким образом, появляется большая потребность во внедрении медицинских информационных систем. Если перед вами стоит задача спроектировать или разработать систему для больницы, вы должны знать общепринятые стандарты и понимать какой набор подсистем лучше реализовать в конечном продукте. Данная статья может помочь архитектору программного обеспечения или программисту быстро получить представление о задачах медицинских информационных систем, узнать об общепринятых стандартах, таких как Health Level 7 (HL7) и DICOM, а также понять, с чего начать работу над проектом.

Ключевые слова: медицинская информационная система, HL7, DICOM, Компоненты МИС.

Hospital information system (HIS) is an integrated information system that improves patient care, simplifies financial operations and provides service control. To develop information systems for hospitals we

should follow certain rules. The purpose of this article is to review the main recommendations for the construction of information systems for the medical sphere.

Hospital information systems requirements

The most important tasks of the HIS are:

- Storage of information about the patient's state of health and providing easy access to it (maintenance of electronic medical records of patients, sending notifications about non-specific results of research, collection of statistical data of observations of the patient)
- Support for the automated exchange of patient data, often including graphical diagnostic images, between different medical departments
- Effective financial management

High quality of data storage, speed of data transmission, ease of access to data are essential conditions for the effective operation of hospital information systems.

In addition, such systems should provide information only to authorized persons. Therefore, access to the hospital information system should be restricted. Currently, it is better to use role-based access control (RBAC).

Two basic standards for the development of hospital information systems are described below.

1. HL7 standard

The HL7 (Health Level Seven) standard was published in 1987 by a group of medical equipment manufacturers in order to create uniform rules for the transfer, exchange and storage of information provided in medical institutions. «Level 7» in the name indicates that this standard refers to the seventh level of the OSI (Open Systems Interconnection) model, called the application layer. Therefore, medical applications can use multiple communication protocols, and at the application level they will communicate using the HL7 standard. The most used set of communication protocols for HL7 is TCP/IP.

HL7 specification based on RIM (Reference Information Model), which includes Use Case Models, Information Models, Interaction Models, Message Models, and Implementable Message Specifications. The RIM is an object model and large, visual representation of the HL7 clinical data (domains) and identifies the life cycle of a message or groups of related messages. RIM uses graphical UML notation.

In 1994, ANSI (American National Standards Institute) officially recognized it as an industry standard. Currently, HL7 is used all over the world.

2. Dicom standard

With the increasing use of CT scanners and other image-based diagnostic devices and the need to transfer this information between different software applications, ACR (American College of Radiology) and NEMA (National Electrical Manufacturers Association) developed the DICOM (Digital Imaging and Communications in Medicine) standard for medical digital information in 1983. It allows the exchange of data including digital medical images between devices manufactured by different companies and the development of Picture Archiving and Communication Systems (PACS).

The DICOM standard describes the transmission procedure, command semantics, syntax, and the format of information that can be transmitted using the protocol. Unlike HL7, which covers more general aspects of medical digital data processing, DICOM is mainly dedicated to medical imaging.

In a heterogeneous system for the integration of medical equipment supplied by different manufacturers, the use of DICOM and HL7 standards is mandatory.

3. Main components of the HIS

In addition to the knowledge of standards, it is necessary to understand what components should be included in the developed system.

Table 1 presents some of the modules that are recommended for use in hospital information systems.

Table 1 – Modules of hospital information system

Module	**Description**
Admission subsystem	information about the patients' admissions
Bed Management subsystem	control of admission and discharge of patients
Blood Bank	blood donation information
Decision Making Support subsystem	assistance in decision-making
Dietary subsystem	planning the provision of food to inpatients in accordance with the instructions of the dietitian
Electronic Medical Record (EMR)	storage of information about the patient, the conducted receptions and researches
Financial Accounting subsystem	control of income and expenses
Laboratory subsystem	record and provide results of medical tests
Outpatient subsystem	registration of new patients and provision of information about them
Personnel and Scheduling subsystem	storage of information about personnel and its

	employment, payroll
Pharmacy subsystem	monitoring the availability of drugs in a medical department
Resource Management subsystem	inventory of goods and property for medical purposes
Security Service	information security and access restrictions
Telemedicine Service	provision of remote medical services
Terminology Service	support coordination with international organizations through the clinical coding of diagnoses, procedures and observations

The deployment of information systems in hospitals is necessary to improve the accuracy and speed up the provision of services to patients and paperwork, quick search for information. DICOM and HL7 standards form the basis of information integration of medical software processes, provide the necessary tools and technologies for the development of software applications. Focusing on the set of components that are recommended to be included in the hospital information system, you can create a good software product.

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